

Claims

We claim:

- 5 1. A computer-implemented method for creating a prototype that includes motion control, machine vision, and data acquisition (DAQ) functionality, the method comprising:

 displaying a graphical user interface (GUI) that provides GUI access to a set of operations, wherein the set of operations includes one or more motion control operations,
10 one or more machine vision operations, and one or more DAQ operations;

 receiving user input to the graphical user interface specifying a sequence of operations, wherein the specified sequence of operations includes at least one motion control operation, at least one machine vision operation, and at least one data acquisition operation; and

15 storing information representing the specified sequence of operations in a data structure, wherein the specified sequence of operations comprises the prototype.

2. The method of claim 1, further comprising:

 accessing the information representing the sequence of operations to determine
20 program instructions corresponding to operations in the sequence; and
 executing the program instructions.

3. The method of claim 1,

 wherein said receiving user input to the graphical user interface specifying the
25 sequence of operations comprises receiving user input to the graphical user interface specifying parameter values for one or more operations in the sequence;

 wherein said storing information representing the specified sequence of operations comprises storing the parameter values;

 wherein the method further comprises executing software routines corresponding
30 to operations in the sequence, wherein said executing comprises passing the parameter values to the software routines.

4. The method of claim 1,
wherein the information does not comprise programming language code.

5. The method of claim 1,
5 wherein said receiving user input to the graphical user interface specifying the
sequence of operations does not include receiving user input specifying programming
language code to implement the sequence of operations.

6. The method of claim 1,
10 wherein the prototype is operable to perform one or more of:
control motion of a device;
acquire images;
analyze the acquired images; and
acquire measurement data.

7. The method of claim 1,
15 wherein the prototype is operable to perform two or more of:
control motion of a device;
acquire images;
20 analyze the acquired images; and
acquire measurement data.

8. The method of claim 1,
25 wherein the prototype is operable to:
control motion of a device;
analyze acquired images; and
acquire measurement data.

9. The method of claim 1,
30 wherein the prototype is operable to:
control a motion control device to move an object;

control an image acquisition device to acquire one or more images of the object; and

control a data acquisition device to acquire measurement data of the object.

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10. The method of claim 1, further comprising:

executing the sequence of operations;

wherein said executing the sequence of operations comprises performing each operation in the sequence.

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11. The method of claim 1, further comprising:

creating program instructions executable to perform the specified sequence of operations;

wherein said performing the specified sequence of operations comprises executing the program instructions.

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12. The method of claim 1, further comprising:

receiving user input to the graphical user interface for configuring one or more of the operations in the sequence;

wherein, for each operation, said configuring the operation affects an action which the operation is operable to perform.

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13. The method of claim 12,

wherein said receiving user input to the graphical user interface for configuring one or more of the operations in the sequence does not include receiving user input specifying programming language code to configure the operations.

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14. The method of claim 12, further comprising:

for each operation to be configured, displaying a graphical panel including graphical user interface elements for setting properties of the operation and receiving user input to the graphical panel to set one or more properties of the operation.

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15. The method of claim 14,
wherein the graphical panel is automatically displayed in response to adding the
operation to the sequence.

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16. The method of claim 14, further comprising:
receiving user input requesting to configure a first operation; and
displaying a graphical panel for configuring the first operation in response to the
request.

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17. The method of claim 1,
wherein the graphical user interface includes an area which visually represents the
operations in the sequence;
wherein the method further comprises:

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for each operation added to the sequence, updating the area visually
representing the operations in the sequence to illustrate the added operation.

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18. The method of claim 17,
wherein the area visually representing the operations in the sequence displays a
plurality of icons, wherein each icon visually indicates one of the operations in the
sequence;

wherein said updating the area visually representing the operations in the
sequence to illustrate the added operation comprises displaying a new icon to visually
indicate the added operation.

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19. The method of claim 1,
wherein the graphical user interface displays a plurality of buttons, wherein each
button is operable to add a new operation to the sequence in response to user input;
wherein said receiving user input to the graphical user interface specifying a
desired sequence of operations comprises receiving user input to the plurality of buttons
to create the sequence of operations.

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20. The method of claim 1,
wherein the one or more motion control operations include:

a straight line move operation;
an arc move operation; and
a contoured move operation.

21. The method of claim 1, wherein the sequence includes one or more motion
control operations, and wherein the method further comprises:

displaying one or more views of the motion control performed by the motion
control operations in the sequence on the graphical user interface, wherein the one or
more views graphically preview the cumulative movement specified by the motion
control operations in the sequence.

22. The method of claim 21,
wherein the one or more views includes a two-dimensional position view for
viewing a two-dimensional display of position data of the sequence in one or more of an
XY, YZ, or ZX plane.

23. The method of claim 21,
wherein the one or more views includes a three-dimensional position view for
viewing a three-dimensional display of position data of the sequence.

24. The method of claim 1, further comprising:
programmatically generating a graphical program operable to perform the
specified sequence of operations; and
executing the graphical program to perform the specified sequence of operations.

25. The method of claim 24,
wherein the graphical program comprises a plurality of interconnected nodes that
visually indicate functionality of the graphical program.

26. The method of claim 24,
wherein the graphical program comprises a graphical data flow program.

5 27. The method of claim 1, further comprising:
programmatically generating a text-based program operable to perform the
specified sequence of operations; and
executing the text-based program to perform the specified sequence of operations.

10 28. The method of claim 1, further comprising:
receiving a request from a computer program to execute the specified sequence of
operations, wherein the computer program was not used to create the sequence of motion
control operations; and
executing the specified sequence of operations in response to the request.

15 29. The method of claim 1, further comprising:
programmatically converting the sequence of operations to a format usable for
configuring an embedded device to perform the sequence of operations; and
configuring the embedded device to perform the sequence of operations using the
20 format.

30 30. A computer-implemented method for creating a prototype that includes
motion control, machine vision, and data acquisition (DAQ) functionality, the method
25 comprising:

displaying a graphical user interface (GUI) that provides GUI access to a set of
operations, wherein the set of operations includes one or more motion control operations,
one or more machine vision operations, and one or more DAQ operations;

30 receiving user input to the graphical user interface specifying a sequence of
operations, wherein the specified sequence of operations implements the motion control,
machine vision, and DAQ functionality of the prototype; and

performing the specified sequence of operations.

31. The method of claim 30,

wherein said receiving user input to the graphical user interface specifying the
5 sequence of operations does not include receiving user input specifying programming
language code to implement the sequence of operations.

32. The method of claim 30, further comprising:

storing information representing the specified sequence of operations in a data
10 structure in response to said receiving user input specifying the sequence of operations.

33. The method of claim 32,

wherein the information does not comprise programming language code.

15 34. The method of claim 32, wherein said performing the sequence of
operations comprises:

accessing the information representing the sequence of operations to determine
program instructions corresponding to operations in the sequence; and
executing the program instructions.

20 35. The method of claim 32,

wherein said receiving user input to the graphical user interface specifying the
sequence of operations comprises receiving user input to the graphical user interface
specifying parameter values for one or more operations in the sequence;

25 wherein said storing information representing the specified sequence of
operations comprises storing the parameter values;

wherein said performing the sequence of operations comprises executing software
routines corresponding to operations in the sequence, wherein said executing comprises
passing the parameter values to the software routines.

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36. A computer-implemented method for creating a prototype that includes motion control, machine vision, and data acquisition (DAQ) functionality, the method comprising:

receiving user input specifying a sequence of operations, wherein the specified
5 sequence of operations includes at least one motion control operation, at least one machine vision operation, and at least one data acquisition operation; and

recording the specified sequence of operations in a data structure, wherein the specified sequence of operations comprises the prototype;

wherein the operations in the sequence are operable to:

10 control a motion control device to move an object;
control an image acquisition device to acquire one or more images of the object; and
control a data acquisition device to acquire measurement data of the object.

37. A memory medium for creating a prototype that includes motion control, machine vision, and data acquisition (DAQ) functionality, the memory medium comprising program instructions executable to:

20 display a graphical user interface (GUI) that provides access to a set of operations, wherein the set of operations includes one or more motion control operations, one or more machine vision operations, and one or more DAQ operations;

receive user input to the graphical user interface specifying a sequence of operations, wherein the specified sequence of operations includes at least one motion
25 control operation, at least one machine vision operation, and at least one data acquisition operation; and

store information representing the specified sequence of operations in a data structure, wherein the specified sequence of operations comprises the prototype.

38. The memory medium of claim 37, further comprising program instructions executable to:

access the information representing the sequence of operations to determine program instructions corresponding to operations in the sequence; and execute the program instructions.

5 39. The memory medium of claim 37,
 wherein said receiving user input to the graphical user interface specifying the sequence of operations comprises receiving user input to the graphical user interface specifying parameter values for one or more operations in the sequence;

10 wherein said storing information representing the specified sequence of operations comprises storing the parameter values;

 wherein the memory medium further comprises program instructions executable to execute software routines corresponding to operations in the sequence, wherein said executing comprises passing the parameter values to the software routines.

15 40. The memory medium of claim 37,
 wherein the information does not comprise programming language code.

20 41. The memory medium of claim 37,
 wherein said receiving user input to the graphical user interface specifying the sequence of operations does not include receiving user input specifying programming language code to implement the sequence of operations.

25 42. The memory medium of claim 37,
 wherein the prototype is operable to:
 control motion of a device;
 analyze acquired images; and
 acquire measurement data.

30 43. A system for creating a prototype that includes motion control, machine vision, and data acquisition (DAQ) functionality, the system comprising:

a processor;
a memory storing program instructions;
a display device;
wherein the processor is operable to execute the program instructions stored in the

5 memory to:

displaying a graphical user interface (GUI) on the display device that provides GUI access to a set of operations, wherein the set of operations includes one or more motion control operations, one or more machine vision operations, and one or more DAQ operations;

10 receive user input to the graphical user interface specifying a sequence of operations, wherein the specified sequence of operations includes at least one motion control operation, at least one machine vision operation, and at least one data acquisition operation; and

store information representing the specified sequence of operations in a data structure, wherein the specified sequence of operations comprises the prototype.

44. A system for creating a prototype that includes motion control, machine vision, and data acquisition (DAQ) functionality, the system comprising:

means for displaying a graphical user interface (GUI) that provides GUI access to a set of operations, wherein the set of operations includes one or more motion control operations, one or more machine vision operations, and one or more DAQ operations;

means for receiving user input to the graphical user interface specifying a sequence of operations, wherein the specified sequence of operations includes at least one motion control operation, at least one machine vision operation, and at least one data acquisition operation; and

means for storing information representing the specified sequence of operations in a data structure, wherein the specified sequence of operations comprises the prototype.

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